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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/643,644	08/19/2003	Roberta J. Cochrane	ARC920030030US1	5236

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FREDERICK W. GIBB, III
Gibb & Rahman, LLC
2568-A RIVA ROAD
SUITE 304
ANNAPOLIS, MD 21401

EXAMINER	
SAHED, USMAAN	

ART UNIT	PAPER NUMBER
2166	

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05/14/2008	PAPER

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary	Application No.	Applicant(s)	
	10/643,644	COCHRANE ET AL.	
	Examiner	Art Unit	
	USMAAN SAEED	2166	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *28 January 2008*.

2a)☒ This action is **FINAL**. 2b)☐ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1,3,4,8,10,11,15,17,21,23 and 24* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1,3,4,8,10,11,15,17,21,23 and 24* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *19 August 2003* is/are: a)☒ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☐ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____.
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____.

DETAILED ACTION

Response to Amendment

1. Receipt of Applicant's Amendment, filed 01/28/2008 is acknowledged.

Claims 1, 3-4, 8, 10, 11, 15, 17, 21, and 23-24 have been amended and claims 2, 5-7, 9, 12-14, 16, 18-20, 22, and 25-27 have been cancelled.

Claim Rejections - 35 USC § 103

2. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

Claims 1, 3-4, 8, 10-11, 15, 17, 21, and 23-24 are rejected under 35 U.S.C. 103(a) as being unpatentable over **Lehner et al.** (**Lehner** hereinafter) (NPL "Maintenance of Cube Automatic Summary Tables" ACM 200 PG's 512-513) in view of **Mumick et al.** (**Mumick** hereinafter) (U.S. Patent No. 6,484,159).

With respect to claim 1, **Lehner** teaches **a method of incrementally maintaining algebraic functions in automatic summary tables (ASTs) of at least one relational database, said method comprising:**

"associating a work area with each algebraic function in each AST" as the set of aggregate functions is restricted to SUM and COUNT. Every AST must have a

COUNT(*) column. If a column X is nullable and the AST computes SUM(X), a named COUNT(X) column is also required (**Lehner** 2. Definition of AST's, Pg 512).

"populating variables within each work area for each algebraic function when each AST is created and when each AST is updated" as the set of aggregate functions is restricted to SUM and COUNT. Every AST must have a COUNT(*) column. If a column X is nullable and the AST computes SUM(X), a named COUNT(X) column is also required (**Lehner** 2. Definition of AST's Pg 512). *STEP II: Aggregating the Delta*. In this step, the delta stream is aggregated. If the underlying modification is an insertion or deletion, then the grouping specification contains all the combinations specified by the AST. For ASTs with complex grouping expressions, e.g. CUBE(), this step results in a complete delta cube with 'higher' delta aggregate values for all original delta changes. If the modification is an update, then the grouping specification contains all the combinations specified by the AST extended with the tag column. For updates, the resulting aggregate values are multiplied with the value of the tag, and a second delta aggregation step consisting of a simple aggregation over all grouping columns plus all grouping function columns is added to eliminate the tag column and compute the net aggregate changes (i.e. delta value) from the old to the new base table values (**Lehner** 3. Incremental Maintenance, Pg 513).

"maintaining each work area by adding and subtracting to and from associated variables of each work area when associated data changes in said relational database" as the set of aggregate functions is restricted to SUM and COUNT. Every AST must have a COUNT(*) column. If a column X is nullable and the

AST computes SUM(X), a named COUNT(X) column is also required (**Lehner** 2. Definition of AST's Pg 512). *STEP II: Aggregating the Delta*. In this step, the delta stream is aggregated. If the underlying modification is an insertion or deletion, then the grouping specification contains all the combinations specified by the AST. For ASTs with complex grouping expressions, e.g. CUBE(), this step results in a complete delta cube with 'higher' delta aggregate values for all original delta changes. If the modification is an update, then the grouping specification contains all the combinations specified by the AST extended with the tag column. For updates, the resulting aggregate values are multiplied with the value of the tag, and a second delta aggregation step consisting of a simple aggregation over all grouping columns plus all grouping function columns is added to eliminate the tag column and compute the net aggregate changes (i.e. delta value) from the old to the new base table values (**Lehner** 3. Incremental Maintenance, Pg 513).

"computing each algebraic function" STEP IV: Aggregate Value Compensation. When a delta group has a corresponding group in the AST, then the new value for the group must be computed based on the value of the delta and the current value of the group. Since the AVG aggregation function can be mapped to an equivalent SUM/COUNT expression, '+' is the only aggregation value compensation function, required to support SUM, COUNT, and AVG (**Lehner** 3. Incremental Maintenance, Pg 513).

"reporting said algebraic function to a user" as transparently rerouting user queries originally referencing base tables to those views [4], and (c) maintaining ASTs, i.e. synchronizing them with the base tables (**Lehner** 1. Introduction).

Lehner teaches the elements of claim 1 as noted above but does not explicitly discloses **"Multiple algebraic functions" and "wherein multiple algebraic functions share the same work area."**

However, **Mumick** teaches **"Multiple algebraic functions"** as simple algebraic expressions for maintenance of view expressions involving outerjoin operators (**Mumick** Col 17, Lines 29-31).

"wherein multiple algebraic functions share the same work area" as simple algebraic expressions for maintenance of view expressions involving outerjoin operators (**Mumick** Col 17, Lines 29-31). An aggregate function is defined as distributive if it can be computed by partitioning the input parameters into disjoint sets of parameters, aggregating each set individually, then further aggregating the (partial) results from each set into the final result (**Mumick** Col 12, Lines 55-59 and Col 16, Lines 40-65).

It would have been obvious to one of ordinary skill in the art at the time the invention was made to combine the teaching of the cited references because **Mumick's** teachings would have allowed **Lehner** to provide significantly faster modification of the operators than the iterative algorithms by implementing higher level change table to the materialized view using a refresh operation.

With respect to claim 3, **Lehner** teaches **"wherein said multiple algebraic function share the same work area when one of: said algebraic function match exactly; said algebraic function match partially; and said algebraic functions have an intersection"** as STEP III: Pairing the Delta to the AST. After aggregation, the rows in the delta are paired with the current content of the AST using a left outer-join (the delta goes left) over the grouping and grouping function columns of the AST. Thus a delta group either matches with a single group of the summary table or no group at all. Delta groups that have matches cause the corresponding row in the AST to be modified; those that do not have matches are later added to the AST. STEP IV: Aggregate Value Compensation. When a delta group has a corresponding group in the AST, then the new value for the group must be computed based on the value of the delta and the current value of the group. Since the AVG aggregation function can be mapped to an equivalent SUM/COUNT expression, '+' is the only aggregation value compensation function, required to support SUM, COUNT, and AVG (**Lehner** 3. Incremental Maintenance, Pg 513).

With respect to claim 4, **Lehner** teaches **"wherein said computing process comprises recomputing said algebraic function after one or more of said variables have changed"** as the advantage of an incremental maintenance strategy is that the changes in the AST are computed directly from the changes of the base table. Consider an AST containing a join over several tables. Incremental maintenance can compute the changes to the AST using the joins of only the changes of the base tables

(deltas) with all other tables of the AST definition (**Lehner** 3.Incremental Maintenance, Pg 512). If an AST is declared 'REFRESH DEFERRED' then no base table changes are propagated when a base table is modified. In lieu of sophisticated algorithms [3], refreshing a deferred AST implies full recomputation (**Lehner** 2.Definiation of AST's, Pg 512).

Mumick further teaches in order to keep the views in the data warehouse up to date, it is necessary to maintain the materialized views in response to the changes at the sources. The view can be either recomputed from scratch, or incrementally maintained by propagating the base data changes onto the view so that the view reflects the changes (**Mumick** Col 1, Lines 15-20).

Claims 8, 10-11, 15, 17, 21, 23-24 are same as claims 1, 3-4 and are rejected for the same reasons as applied herein above.

Response to Arguments

3. Applicant's arguments filed on 01/28/2008 have been fully considered but they are not persuasive.

Applicant argues that the **Lehner and Mumick** do not teach or suggest **"wherein multiple algebraic functions share the same work area."**

In response to the preceding arguments examiner respectfully submits that Mumick teaches **"wherein multiple algebraic functions share the same work area"**

as simple algebraic expressions for maintenance of view expressions involving outerjoin operators (**Mumick** Col 17, Lines 29-31). An aggregate function is defined as distributive if it can be computed by partitioning the input parameters into disjoint sets of parameters, aggregating each set individually, then further aggregating the (partial) results from each set into the final result (**Mumick** Col 12, Lines 55-59).

Further **Mumick** discloses the techniques developed in this section are illustrated as applied to the views of the motivating Example 1. Recall from Example 1 the definitions of V.sub.1 (SISales), V.sub.2 (CitySales), and V.sub.3 (CategorySales). Thus:

V.sub.1 '=.pi..sub.storeID,itemID,SumSISales=sum(price), NumSISales=count(*) (sales)

V.sub.2 =.pi..sub.city,itemID,SumSISales=sum(price),NumSISales=count(*) (V.sub.2 ')

V.sub.3 =.pi..sub.category,SumCaSales=sum(SumSISales),NumCaSales= sum (NumSISales)(V.sub.3 ') (**Mumick** Col 16, Lines 40-65).

In these lines **Mumick** teaches algebraic functions, which use the same functions and compute the same values for their work areas. Algebraic functions V.sub.1, V.sub.2, and V.sub.3, share the same work areas such as ((SumSISales), (NumSISales)).

Conclusion

4. **THIS ACTION IS MADE FINAL.** Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the mailing date of this final action.

Contact Information

5. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Usmaan Saeed whose telephone number is (571)272-4046. The examiner can normally be reached on M-F 8-5.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Hosain Alam can be reached on (571)272-3978. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

Usmaan Saeed
Patent Examiner
Art Unit: 2166

/Hosain T Alam/
Supervisory Patent Examiner, Art Unit 2166

Hosain Alam
Supervisory Patent Examiner

US
May 09, 2008